We claim:

1. A process for burning a fuel to produce a flue gas, the process comprising:

burning the fuel in a main combustion zone in the presence of a main combustion oxidant to produce combustion products;

mixing the combustion products in a post-combustion zone positioned downstream from the main combustion zone, the post-combustion zone having a recirculation zone positioned proximate to the main combustion zone and an injection zone positioned downstream from the recirculation zone;

injecting a post-combustion oxidant into the combustion products in the injection zone; and

controlling at least one of (a) the residence time of the combustion products in the post-combustion zone, (b) the temperature range of the combustion products contained within the injection zone and (c) the oxygen content of the oxidant, to optimize the level of CO and NO_x in the flue gas.

2. A process for burning a fuel to produce a flue gas, the process comprising:

burning the fuel in a main combustion zone in the presence of a main combustion oxidant to produce combustion products;

mixing the combustion products in a post-combustion zone positioned downstream from the main combustion zone, the post-combustion zone having a recirculation zone positioned proximate to the main combustion zone and an injection zone contained within the recirculation zone;

injecting a post-combustion oxidant into the combustion products in the injection zone; and

controlling at least one of (a) the residence time of the combustion products in the post-combustion zone, (b) the temperature range of the combustion products contained within the injection zone and (c) the oxygen content of the oxidant, to optimize the level of CO and NO_x in the flue gas.

3. The process of Claim 1 wherein the temperature of the combustion products contained within the post-combustion zone is maintained between about 800°C and about 1300°C.

4. The process of Claim 3 wherein the temperature of the combustion products contained within the post-combustion zone is maintained between about 800°C and about 1100°C.

5. The process of Claim 1 wherein the post-combustion zone is provided with at least one baffle.

6. The process of Claim 5 wherein the post-combustion zone is provided with a plurality of baffles.

7. The process of Claim 6 wherein the baffles are oriented substantially perpendicular to the general direction of flow of the combustion products.

8. The process of Claim 6 wherein the baffles are disposed in staggered relation to one another.

9. The process of Claim 8 wherein the baffles are oriented substantially perpendicular to the general direction of flow of the combustion products.

10. The process of Claim 1 wherein the post-combustion zone is provided with a diffuser.

11. The process of Claim 1 wherein the post-combustion oxidant is injected into the combustion products in axial, countercurrent relation to the direction of flow of the combustion products.

12. The process of Claim 1 wherein the post-combustion oxidant is injected into the combustion products in radial, perpendicular relation to the direction of flow of the combustion products.

13. The process of Claim 1 wherein the post-combustion oxidant is injected into the combustion products in radial and tangential relation to the direction of flow of the combustion products to produce a swirl pattern within the flow of the combustion products.

14. The process of Claim 1 wherein the post-combustion oxidant is injected into the combustion products in oblique, countercurrent relation to the direction of flow of the combustion products.

15. The process of Claim 1 wherein the post-combustion oxidant is injected into the combustion products at an average velocity of between about 5 meters per second and about 120 meters per second.

16. The process of Claim 1 wherein the post-combustion oxidant is injected into the combustion products with at least one lance.

17. The process of claim 1 wherein the post-combustion oxidant is injected in the combustion products in a staged relation to the direction of flow of the combustion products.

18. The process of Claim 1, wherein the stoichiometric amount of oxygen contained in the main oxidant is between about 0.7 and 1.0 of the amount necessary for complete combustion.

19. The process of Claim 1 wherein the total oxygen composition of the post-combustion oxidant entering the oxidant chamber exceeds 21%.

20. The process of Claim 19 wherein the total oxygen composition of the post-combustion oxidant entering the oxidant chamber is between 21% and 35%.

21. The process of Claim 1 wherein a heat-absorbing material is injected into the main combustion zone during the burning to reduce the temperature of the combustion products within the combustion zone.

22. The process of Claim 1 wherein the burning is conducted by oscillating combustion process techniques.

23. The process of Claim 18 wherein the burning is conducted by oscillating combustion process techniques.

24. The process of Claim 20 wherein the burning is conducted by oscillating combustion process techniques.

25. A process for burning a fuel to produce a flue gas, the process comprising:

burning the fuel in a main combustion zone in the presence of a main combustion oxidant to produce combustion products;

mixing the combustion products in a post-combustion zone positioned downstream from the main combustion zone, the post-combustion zone having a recirculation zone positioned proximate to the main combustion zone and an injection zone positioned downstream from the recirculation zone;

the post-combustion zone being provided with at least one of a diffuser or a plurality of baffles oriented substantially perpendicular to the general direction of flow of the combustion products and being disposed in staggered relation to one another;

maintaining the temperature of the combustion products contained within the post-combustion zone between about 800°C and about 1100°C;

injecting with at least one lance a post-combustion oxidant into the combustion products in the injection zone at an average velocity of between about 5 meters per second and about 120 meters per second;

maintaining the stoichiometric amount of oxygen contained in the main oxidant to be between about 0.7 and 1.0 of the amount necessary for complete combustion;

maintaining the total oxygen composition of the post-combustion oxidant entering the oxidant chamber to be between 21% and 35%;

injecting a heat-absorbing material into the main combustion zone during the burning to reduce the combustion temperature within the combustion zone;

conducting the burning by oscillating combustion process techniques; and

controlling at least one of (a) the residence time of the combustion products in the post-combustion zone, (b) the temperature of the combustion products contained within the injection zone and (c) the oxygen content of the oxidant, to optimize the level of CO and NO_x in the flue gas.

26. The process of Claim 25 wherein the post-combustion oxidant is injected into the combustion products in axial, countercurrent relation to the direction of flow of the combustion products.

27. The process of Claim 25 wherein the post-combustion oxidant is injected into the combustion products in radial, perpendicular relation to the direction of flow of the combustion products.

28. The process of Claim 25 wherein the post-combustion oxidant is injected into the combustion products in radial, offset relation to the direction of flow of the combustion products to produce a swirl pattern within the flow of the combustion products.

29. The process of Claim 25 wherein the post-combustion oxidant is injected into the combustion products in oblique, countercurrent relation to the direction of flow of the combustion products.

30. A process for burning a fuel to produce a flue gas, the process comprising:

burning the fuel in a main combustion zone in the presence of a main combustion oxidant to produce combustion products;

mixing the combustion products in a post-combustion zone positioned downstream from the main combustion zone, the post-combustion zone having a recirculation

zone positioned proximate to the main combustion zone and an injection zone positioned downstream from the recirculation zone;

injecting a post-combustion oxidant into the combustion products in an injection zone positioned downstream from the main combustion zone; and

combusting the combustion products with the post-combustion oxidant, thereby optimizing the levels of CO and NO_x in the flue gas.

31. A process of retrofitting a boiler comprising a combustion apparatus having a main combustion zone configured for burning fuel in the presence of a main combustion oxidant to produce combustion products, the process comprising:

providing a mixing device downstream of the main combustion zone positioned and configured to increase a residence time of the combustion products in a recirculation zone proximate to the main combustion zone in comparison to an absence of the mixing device;

providing an injection device positioned and configured to inject a post-combustion oxidant into the combustion products in the injection zone, thereby facilitating combustion of the combustion products and the post-combustion oxidant such that levels of CO and NO_x resulting therefrom are optimized.